LAWRENCE LIVERMORE
REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Jan. 3-7, 2011

Waiting it out

A mother and her children practice going to their $5,000 steel backyard fallout shelter in Sacramento, Calif. in 1961.

In an urban nuclear attack, the best tactic is to stay inside your home and wait.

The Lab's Brooke Buddemeier has been preaching this since he began working on a multi-agency modeling effort funded by the Department of Homeland Security. He looked at Washington, D.C., New York, Chicago, Los Angeles and other big cities, using computers to simulate details of both the urban landscape and terrorist bombs.

"A nuclear detonation is a darn big explosion," he says. "But it generates fallout."

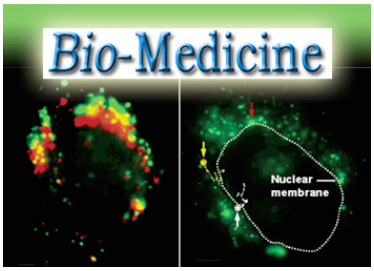
The fallout from an improvised nuclear device, the type that a terrorist might set off on the ground, is different than the tactical nuclear weapons strikes that were feared during the Cold War, Buddemeier says.

The goal is: "A little bit of shelter can save a lot of lives."

And the best shelter is getting away from the roof and ground where fallout is likely to accumulate. Staying indoors or in an underground parking garage or basement for 12 to 24 hours would be the safest place to be.

To hear the full interview, go to the Web.

Inside a living cell



The two images shown portray the movement of the nano-sized probes. Biologists may soon use nanotechnology to watch the inner workings of a living cell like never before.

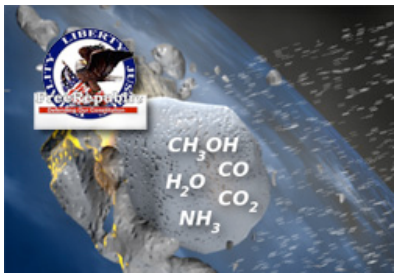
Lab and Lawrence Berkeley National Lab scientists have developed a way to sneak nano-sized probes inside cell nuclei where they can track life's fundamental processes, such as DNA repair, for hours on end.

"Our work represents the first time a biologist can image long-term phenomena within the nuclei of living cells," says Fanqing Chen of Berkeley Lab's Life Sciences Division, who developed the technique with Daniele Gerion of Lawrence Livermore National Laboratory.

The technique uses specially prepared crystalline semiconductors composed of a few hundred or thousand atoms that emit different colors of light when illuminated by a laser.

To read more, go to the Web.

Life, but not quite as we know it



Computer simulations show that long chains containing carbon-nitrogen bonds can form during shock compression of a cometary ice. Upon expansion, the long chains break apart to form complexes containing the protein building amino acid glycine. ***Images by Liam Krauss/LLNL***

What discoveries caused the biggest buzz in chemistry labs around the world in 2010? With the help of an expert panel of journal editors, *Chemistry World* reviewed the ground breaking research and important trends in the year's chemical science papers.

And the Lab's Nir Goldman had one of them.

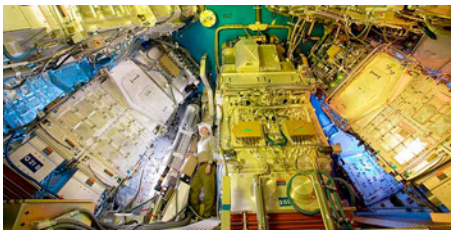
Goldman and co-workers at the Laboratory and Stanford University suggested that the early building blocks of life could survive hitching a ride to earth on a comet. Their computations found that the impact of the shock waves from a comet that crashed into Earth millions of years ago could have produced amino acids.

Amino acids are critical to life and serve as the building blocks of proteins, which are linear chains of amino acids.

Goldman determined that simple molecules found within comets (such as water, ammonia, methylene and carbon dioxide) just might have been instigators of life on Earth. His team discovered that the sudden compression and heating of cometary ices crashing into Earth can produce complexes resembling the amino acid, glycine.

For more, go to the Web.

NIF's green articles ranked high



The National Ignition Facility was recently ranked as the third most read article in the *International Business Times* in 2010.

The *International Business Times* compiled a list of the 12 most read green energy articles it published in 2010.

The article, which originally ran in October, reports that NIF attained partial achievement of nuclear fusion in 2010 and that ultimately, fusion will be achieved later this year.

On Sept. 29, NIF proved the theory was right by firing its 192 laser beams on a tiny frozen hydrogen pellet, producing the fusion of some tritium and deuterium atoms.

To read more, go to the Web.

There is water under the water

The Earth's largest aquifer system resides below the ocean in the pore spaces of basalt, the volcanic rock that makes up most of the ocean crust.

Laboratory and UC Santa Cruz researchers have found that there is an extensive biological community living in this porous rock beneath the deep ocean floor. It's a deep water home to millions of microbes that lies well beneath the water at the ocean's upper levels.

The microbes appear to be an important source of dissolved organic matter in deep ocean water, a finding that could dramatically change ideas about the ocean carbon cycle.

LLNL's Tom Guilderson and UC Santa Cruz' Matthew McCarthy found evidence of the hidden microbial ecosystem beneath the seafloor by analyzing carbon isotopes in the organic molecules in their samples. Of the three naturally occurring isotopes of carbon, carbon-12 is the most abundant, and both carbon-12 and the slightly heavier carbon-13 are stable. Carbon-14 is an unstable isotope formed in the upper atmosphere through the action of cosmic rays, and its steady decay is the basis for carbon-dating of organic material.

Guilderson used the Lab's Center for Accelerator Mass Spectrometry to analyze the samples.

To read more, go to the Web.

Keep the meat on the low down -- temperature setting, that is

Laboratory scientists working alongside UC Davis researchers have found that cooking meat at high heat may contribute to prostate cancer.

The theory came from decades of research by James Felton, co-leader of UC Davis Cancer Center's Cancer Etiology, Prevention and Control Program and division leader of the Biosciences Directorate at the Laboratory. He is among the 40 Lawrence Livermore scientists who work as members of UC Davis Cancer Center's Integrated Cancer Research Program, the first formal research partnership uniting a major cancer center and a national laboratory.

The study found that African American men are at high risk of prostate cancer because they consume very high quantities of carcinogens formed in cooked meats, where the meats are cooked at high-heat, such as grilling, roasting, or deep-frying.

Preliminary results from the Oakland study suggest there is indeed a significant dose-response: Not only did the study participants have high PhIP intakes, but the higher their intakes, the higher their PSA levels. PSA, or prostate-specific antigen, is a bloodstream marker for prostate damage and early prostate cancer.

To read more, go to the Web.

Newsline issue lists month-by-month highlights

In keeping with a tradition dating to 1995, a special printed edition of *Newsline* listing Lab month-by-month highlights from 2010 was published today and also is available on the Web here (pdf, 12 pages, 1.3 MB).

This special 12-page edition of *Newsline* lists Lab highlights in four categories: Science and Technology; Operations; People; and Awards and Recognition.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

To send input to the *Livermore Lab Report*, send e-mail mailto:labreport@llnl.gov.

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